CARD CONNECTOR

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a connector for a card such as an IC card.

Description of Related Art

In Fig. 11A, there is shown a connector 80 as a card connector of this type. In the connector 80, an insertion cavity 85 for receiving a card 84 inserted therein is defined, as shown in Fig. 11A, by fixing a synthetic resin frame 82 of a generally open-square shape as seen in plan onto a substrate 81 and covering the frame 82 with a channel-shaped metal frame 83 as shown in Fig. 11B.

In general, an inverted insertion preventing structure for preventing the card 84 from being inserted upside down into the insertion cavity 85 is provided on a side wall 86 of the synthetic resin frame 82.

Lateral sides of the insertion cavity 85 of the connector of Fig. 11A are respectively defined by lateral side walls 86 of the synthetic resin frame 82. This poses a problem that the card connector 80 has a laterally expanded footprint on the substrate 81.

A conceivable approach to reduction of the footprint is to significantly reduce the lengths of the side walls 86 of the synthetic resin frame 82, reduce the thicknesses

of the side walls 86 and define the lateral sides of the insertion cavity 85 by lateral side walls 87 of a cover 83.

In this case, however, the lateral side walls 86 of the synthetic resin frame 82 are disposed in an inner portion of the insertion cavity 85, so that the inverted card insertion preventing structure is disposed in the inner portion of the insertion cavity 85. As a result, a user does not realize the inverted insertion until the card 84 is inserted deeply into the inner portion of the insertion cavity 85.

Hence, there is a possibility that the user forcibly squeezes the card 84 into the innermost position of the insertion cavity 85 to damage the card 84 and the like.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a card connector which assuredly prevents the inverted insertion of a card with a simplified structure.

According to a preferred mode of the present invention to achieve the aforesaid object, there is provided a card connector, which comprises: an insertion cavity for receiving a card inserted therein in a card inserting direction; a first insulative frame fixed to a mounting surface and defining a rear side of the insertion cavity; a plurality of contacts held by the first frame

as facing toward the insertion cavity; a second metal frame of a channel shape fixed to the mounting surface and having a top plate parallel to the mounting surface and first and second side walls to define the insertion cavity between the mounting surface and the second frame; and an inverted card insertion preventing projection provided on one of the first and second side walls of the second frame for preventing the card from being inserted upside down into the insertion cavity, the inverted card insertion preventing projection projecting in an area of the insertion cavity associated with the first half of a card inserting stroke.

According to this mode, the insertion cavity is defined by the first and second side walls of the second frame of the channel-shaped metal plate, so that the footprint of the card connector on the mounting surface can be reduced. In addition, a user is alerted to the inverted cart insertion at a relatively early stage of the card insertion. Thus, the inverted card insertion can assuredly be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded perspective view of a card connector according to one embodiment of the present invention and a card;

Fig. 2 is a perspective view of a first synthetic

resin frame which holds pin contacts;

Figs. 3A and 3B are a plan view and a front view, respectively, of the card connector;

Fig. 4 is a diagram of the card as seen from an ejection side end face thereof;

Fig. 5 is a perspective view of a second frame of a metal plate provided with an eject mechanism as seen from a diagonally lower side;

Fig. 6A is a schematic diagram illustrating a relationship between a card inserted in a normal state and an inverted card insertion preventing projection, and Fig. 6B is a schematic diagram illustrating a relationship between a card inserted in an inverted state and the inverted card insertion preventing projection;

Fig. 7 is a schematic plan view illustrating the relationship between the card inserted in the inverted state and the inverted card insertion preventing projection;

Fig. 8 is a perspective view of a second frame provided with an eject mechanism according to another embodiment of the present invention as seen from a diagonally lower side;

Fig. 9 is a schematic sectional view of an inverted card insertion preventing projection according to further another embodiment of the present invention;

Fig. 10 is a schematic sectional view of an inverted card insertion preventing projection according to still another embodiment of the present invention; and

Figs. 11A and 11B are a schematic plan view and a schematic front view of a conventional card connector.

DESCRIPTION OF THE PREFFERED EMBODIMENTS

Preferred embodiments of the present invention will be described with reference to the attached drawings.

Fig. 1 is an exploded perspective view of a card connector according to one embodiment of the present invention and a card. Referring to Fig. 1, a card connector 1 is a connector in which a card 2 such as an IC card is inserted in an inserting direction X and set, and is constructed such that a first frame 4 of a synthetic resin having an open square shape as shown in Fig. 2 and a second frame 5 of a channel-shaped metal plate as shown in Fig. 1 are provided on a surface of a substrate 3 as a mounting surface 3a. The second frame 5 has a top plate 5a and first and second side walls 5b and 5c.

The card 2 has a front face 2a, a back face 2b, an insertion side end face 2c, an ejection side end face 2d, a first lateral side face 2e and a second lateral side face 2f. Though not shown, the insertion side end face 2c, which serves as a connection face of the card 2, is provided with a multiplicity of socket contacts.

Referring to Fig. 2, on the other hand, the first frame 4 is insulative, and serves as a pin housing in which a multiplicity of pin contacts 6 to be connected to the socket contacts of the card 2 are press-fitted. More specifically, the first frame 4 includes a main portion 7 which holds the pin contacts 6, and a pair of lateral side walls 8 and 9 each having a smaller length and extending from opposite ends of the main portion 7 in a card ejecting direction Y.

Referring to Fig. 1, the connector 1 has an insertion cavity 10 defined between the second frame 5 and the substrate 3 for receiving the card 2 inserted therein in the inserting direction X. The first frame 4 is disposed behind the insertion cavity 10. An eject arm 11 of a metal plate for ejecting the card 2 from the insertion cavity 10 in the ejecting direction Y by pressing the insertion side end face 2c of the card 2 inserted in the insertion cavity 10 is also disposed behind the insertion cavity 10.

Referring to Fig. 1 and Figs. 3A and 3B which are a schematic plan view and a schematic front view, respectively, of the card connector 1, the eject arm 11 is slidable on a lower surface of the top plate 5a of the second frame 5. A pair of first engagement portions 11a (particularly shown in Fig. 3B but only one of the first

engagement portions shown in Figs. 1 and 3A) to be engaged with the insertion side end face 2c of the card 2 are provided at laterally opposite ends of the eject arm 11, and a second engagement portion 11b to be engaged with a metal plate link arm 13 of an eject mechanism 12 is provided at a middle portion of the eject arm 11.

The eject mechanism 12 includes an operation arm 14 of a metal plate manually operated and supported slidably in the card inserting direction X and in the card ejecting direction Y on an outer surface of the second side wall 5c of the second frame 5. The operation arm 14 is supported by a pair of angled guide support members 21 and 22 cut and raised from the second side wall 5c. The operation arm 14 is slidably guided along the outer surface of the second side wall 5c by the guide support members 21 and 22.

The eject mechanism 12 transfers the operation of the operation arm 14 to the eject arm 11 via the link arm 13, whereby the card 2 inserted and set in the insertion cavity 10 is ejected from the insertion cavity 10.

The link arm 13 is pivotal about an axis 15 on an upper surface of the top plate 5a of the second frame 5. This axis 15 is provided by a pivot 16 disposed at a middle position between first and second ends 13a and 13b of the link arm 13.

The second engagement portion 11b of the eject arm 11 is engaged with an engagement hole 17 provided at the first end 13a of the link arm 13. A bent engagement portion 18 provided at the second end 13b of the link arm 13 is engaged with a pair of engagement portions 19 and 20 provided at a first end 14a of the operation arm 14, whereby the second end 13b of the link arm 13 and the end of the operation arm 14 are pivotally coupled to each other.

A support portion 23 of a synthetic resin is fixed to a second end 14b of the operation arm 14, and an operation portion 24 to be depressed by a finger is supported by the support portion 23 pivotally about a predetermined axis 25 within an angular range of, for example, 90 degrees.

After the card 2 is inserted and set in the insertion cavity 10, the operation portion 24 is pivoted upward with respect to the support portion 23 into an out-of-use state for clearance. When the card 2 is to be ejected, the operation portion 24 is reclined from the out-of-use state into an in-use state in alignment with the support portion 23. Though not shown, the operation portion 24 can be kept in the in-use state and in the out-of-use state by a predetermined retention force.

Referring to Fig. 1 and Fig. 4 which illustrates the card 2 as seen from the ejection side end face 2d, first and second grooves 26 and 27 are respectively provided

in the first and second lateral side faces 2e and 2f of the card 2 as extending in the ejecting direction Y to middle portions of the first and second lateral side faces 2e and 2f. As shown in Fig. 4, a width W2 of the second groove 27 is greater than a width W1 of the first groove 26.

Fig. 5 is a perspective view of the second frame 5 provided with the eject arm 11 and the eject mechanism 12 as seen from a diagonally lower side. Referring to Fig. 5, the first and second side walls 5b and 5c of the second frame 5 are respectively provided with first and second grounding projections 28 and 29 projecting inward therefrom. The projections 28 and 29 are each raised from one side of a corresponding opening as having a chevron shape. The projections 28 and 29 are disposed in the vicinity of an entrance to the insertion cavity 10.

Though not shown, the front face 2a, the back face 2b and the lateral side faces 2e and 2f of the card 2 are partly covered with a metal shell, so that electrical connection from the metal shell of the card 2 inserted in the insertion cavity 10 to the substrate 3 via the first and second projections 28 and 29 and the second frame 5 is established for the grounding of the card 2. The first and second projections 28 and 29 may respectively be fitted in the first and second grooves 26 and 27 to guide the

card 2 when the card 2 is inserted. That is, the first and second projections 28 and 29 may also serve as guide projections for the card insertion.

The second side wall 5c which supports the operation arm 14 of the eject mechanism 12 has an inverted card insertion preventing projection 30 provided inward of the second projection 29 (with respect to the inserting direction X) in the insertion cavity 10. The inverted card insertion preventing projection 30 is, for example, angled to project in the insertion cavity 10 as shown in Fig. 3A.

When the card 2 is inserted into the insertion cavity 10 by pressing the ejection side end face 2d thereof, the projections 28 and 29 move in the corresponding grooves 26 and 27 of the card 2 and, at the end of a card inserting stroke, are dislodged from the corresponding grooves 26 and 27 to ride on the corresponding lateral side faces 2e and 2f of the card 2. Thus, the projections 28 and 29 are brought into contact with the metal shell not shown on the lateral side faces 2e and 2f of the card 2 with a resilient depressing force.

However, the projections 28 and 29 are permitted to be fitted in the grooves 27 and 26, respectively, when the card 2 is inserted upside down into the insertion cavity 10 (with the front face 2a and the rear face 2b being

inverted), i.e., when the inverted insertion occurs.

A feature of this embodiment is to assuredly prevent the inverted insertion described above at an early stage of the card insertion. Therefore, the inverted card insertion preventing projection 30 is disposed in a front half portion of the insertion cavity 10, i.e., in an area A associated with the first half of the card inserting stroke (see Fig. 1).

As shown in Fig. 6A, the width W of the inverted card insertion preventing projection 30 is greater than the width W1 of the first groove 26 and smaller than the width W2 of the second groove 27.

Referring to Fig. 6A, when the card 2 is inserted in a normal state with its front face 2a upward, the inverted card insertion preventing projection 30 is fitted in the corresponding wider second groove 27 of the card 2, thereby permitting the card insertion.

On the other hand, when the card 2 is inserted in an inverted state with its rear face 2b upward as shown in Fig. 6B, the inverted card insertion preventing projection 30 is not fitted in the corresponding narrower first groove 26 of the card 2 to abut against the insertion side end face 2c of the card 2, thereby preventing the card insertion.

According to this embodiment, the lateral sides of

the insertion cavity 10 are defined by the pair of side walls 5b and 5c of the second frame 5 of the channel-shaped metal plate, so that the footprint of the card connector 1 on the substrate 3 can be reduced. In addition, a user is alerted to the inverted cart insertion at a relatively early stage of the card insertion by the inverted card insertion preventing projection 30. Thus, the inverted insertion of the card 2 can assuredly be prevented.

The inverted card insertion preventing projection 30 is a projection cut and raised from the second side wall 5c of the second frame 5 and, therefore, the formation thereof is easy and less costly.

Fig. 8 illustrates another embodiment of the present invention. Referring to Fig. 8, this embodiment differs from the embodiment of Fig. 5 in the following points. The first projection 28 provided in the embodiment of Fig. 5 is eliminated in this embodiment. The second projection 29 and the inverted card insertion preventing projection 30 are separately provided in the embodiment of Fig. 5, but an inverted card insertion preventing projection 30A supported at opposite ends thereof and doubling as the second projection is provided as shown in Figs. 8 and 9 in this embodiment for simplification of the structure. Further, the inverted card insertion preventing projection 30A can more flexibly be laid out.

The present invention is not limited to the embodiments described above. For example, an inverted card insertion preventing projection 30B bulged as shown in Fig. 10 may be provided rather than the cut and raised inverted card insertion preventing projection.

While the present invention has thus been described in detail by way of the specific embodiments thereof, those skilled in the art who understand the foregoing description will easily come up with modifications, variations and equivalents of the invention. Therefore, it should be understood that the scope of the invention be defined by the following claims and the equivalents thereof.